Soil Health as Influenced by Organic Matter Content and Microbial Biomass

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INTRODUCTION

- Soil health is the continued ability of the soil as a living system to support environmental quality, plant, animals and humans.
- Soil health indicators such as soil organic matter (SOM), fertility, physical, chemical, and biological properties are measured to show how well the soil functions.
- Plant Root Simulator (PRS) probes use ion exchange resin to study the bioavailability of various nutrients in the soil for fertilizer recommendation.
- MicroBiometer, an on-site test kit, measures microbial biomass as an indicator of soil health.

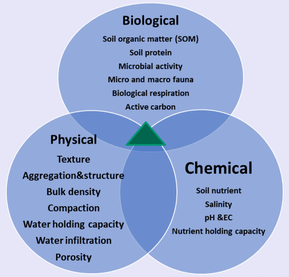

Figure 1. Properties and indicators of soil health

▲ *-- Interaction between Soil Properties as an Indicator for Soil Health*

RESEARCH QUESTIONS

❑ Is there a consistent relationship between organic matter content in the soil and the microbial biomass as measured by MicroBiometer?

OBJECTIVE

- To evaluate the similarities in soil health decisions made with a PRS probe and MicroBiometer test kit.
- Determine the correlation between SOM, N supply rate and Microbial Biomass as measure by MicroBiometer.

MATERIALS & METHODS

- A comparative laboratory experiment, with random and judgemental sample selection.
- Thirty-eight soil samples from different research sites that Western AG Laboratory has previously analyzed with the PRS probe.
- MicroBiometer Test Kit was used to analyze microbial biomass, and then classify each sample into ranges with a smart phone application.
- Four Categories: Excellent, Good, Fair, Low.
- Replication: The number of replication varies between treatment.

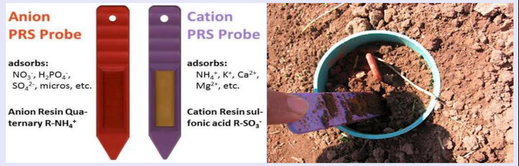

Photo 1. PRS Probe and method of data collection

RESULTS

Photo 2. Microbiometer test kit

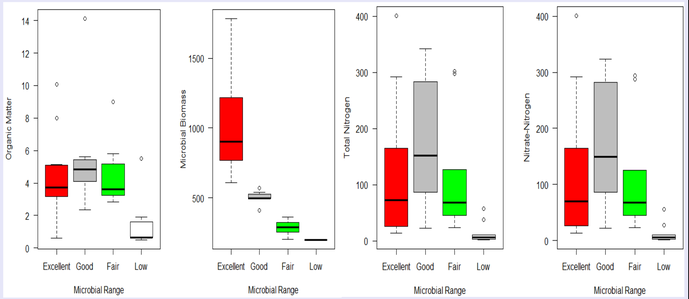

Figure 2. Mean organic matter, microbial biomass, total nitrogen, and nitrate-nitrogen level in each microbial range.

Table 1: PRS Nitrogen supply, Microbial biomass and Organic matter for different Microbiometer range.

Microbiometer Range†	Microbial Biomass	PRS N Supply	OM	n
	ug/g	Ug N/10cm2/d	%	
Excellent	‡10312 ± 108b	120 ± 35b	4.4 ± 0.7b	12
Good	503 ± 19b	179 ± 47a	5.8 ± 1.5a	7
Fair	290 ± 17b	117 ± 36a	4.6 ± 0.7a	9
Low	200±0 b	14 ± 6a	1.3± 0.5a	10
P values§	<.0001	0.05	0.15	

†Microbiometer Range refers to the microbial biomass testing result (<200ug/g: Low, 200-400ug/g: Fair, 400-600ug/g: Good, >600ug/g: Excellent) that categorize samples into microbial range. ‡Mean values ± standard error. Different letters indicate a significant difference between treatment means, according to Tukey's HSD ($P < 0.05$). §Signifies P values showing which treatments are significantly different ($P<0.05$).

DISCUSSION

- Microbial biomass classified as excellent is significantly different from the other categories, while the other categories were not significantly different from each other (Table 1).
- It is expected that the organic matter value will be the highest in the soil samples that falls into the excellent range and lowest at the low microbial biomass range. Figure 2 shows a different trend in the organic matter, and it doesn't give a consistent relationship between organic matter and microbial biomass.
- Apart from the low microbial range, soil nutrients in terms of total nitrogen, nitrate nitrogen and organic matter, dictate the soil health more precisely than simple soil microbial biomass.
- Microbial biomass nutrient aids in sequestering greater degree of carbon in soil by checking CO_2 emission rate.

CONCLUSION

We are unable to specify what is a "good or bad" amount of microbial biomass or respiration rate for a specific soil, unless it gets so extreme that either are very low. In this case simpler indicators are usually indicative of change e.g. total carbon, organic matter.

Microbial biomass as a soil health indicator is attractive but not easily interpretative. The microbial population in the rhizosphere is abundant and highly diverse total count is not important but type of microbes is important.

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